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Rev. 07/10/02

16692
00000-5

State of Illinois
ENVIRONMENTAL PROTECTION AGENCY **MEMORANDUM**

DATE: January 26, 2001

TO: Division File

FROM: Gina Search, P.G.

SUBJECT: January 25, 2001 Meeting

RE: 1631210006 – St. Clair County
Solutia, Inc.
ILD000802702
FOS

On January 25, 2001, a meeting was held with representatives of Solutia, Inc. The agency was represented by:

John Justice – Collinsville Regional Manager/BOA
Ken Mensing – Collinsville Regional Manager/BOL
Nick Mahlandt – Collinsville Regional Manager/BOW
Tom Powell – Collinsville/Emergency Operations
Mark Schlueter – Collinsville/BOA
Gina Search – Collinsville/BOL
Chris Cahnovsky – Collinsville/BOL
Anthony Dulka – BOW/PWS

Solutia, Inc. was represented by:

Alan Faust – ESH Leader
Donald Ridenhower – Community Affairs
Craig Kozicki – Manufacturing Team Leader
Guy Steensgard – Senior Engineering Specialist
Robert Hiller – Environmental Engineer
Tony Mellini – URS Corporation/Operations Manager

Solutia requested to meet with the Agency to discuss the January 7-8, 2001 monochlorobenzene release, their investigation and potential remedies. During the meeting Solutia representatives discussed the incident description and how their staff failed to immediately detect the release. The incident is described in the attached handout. Their investigation of the incident including the tracking process and interviews with employees was reviewed, and Solutia provided a list of findings and suggestions on how they might improve their operating procedures (See attachment, Page 4).

The final calculations for net environmental losses were reported as:

Surface evaporation	80 gallons	700 pounds

Vent losses	280 gallons	2,400 pounds
To subsurface	6,700 gallons	58,000 pounds

Solutia discussed the chemical characteristics of monochlorobenzene and the hydrogeologic setting of the spill (See attached figures 3 & 4). Based on their findings, a 2-Phase Extraction system was proposed as a potential remedy for the subsurface contamination. This system works by applying a high vacuum to recovery wells, which simultaneously draw groundwater, NAPL and soil vapors into the well. Mr. Tony Mellini explained that initially two wells would be installed, one in the SB4 and SB5 area and the other would be installed in monitor well RW1 (See attached figure 1). Five-foot screens would be used to focus the recovery of groundwater and vapor from the upper 14 feet of silts, sands and clays. The effectiveness of this system is dependent on the ability to dewater the shallow low-permeability soils. If this system also draws groundwater from the more permeable underlying sand units, it will not function at optimal efficiency, reducing the amount of soil vapor that can be extracted.

Mr. Mellini reported that the system will be evaluated and updated/expanded as the remediation progresses. The two initial wells will be monitored for recovery capabilities. This data will be used to determine the need for additional wells. Due to the on-site obstructions, the locations for additional wells will be limited to accessible areas.

Initially the recovery wells will pull out free-phase NAPL and water during the dewatering process, amounting to 5-10 gallons per minute. This amount will drop off to .5 gallon per minute after the dewatering is complete. The water will be pumped to a Baker tank and then through a vapor-water separator. The free-phase product will be containerized and the water will be run through carbon before it is discharged to the plant's sewer.

Mr. Faust addressed questions concerning residual and historical contamination. He reported that this system would be addressing some of the historical contamination, as well as the contamination caused by this recent release. He stated that they would attempt to remove the mass of the contamination resulting from the January 7-8, 2001 release with the 2-Phase Extraction system. The residual will be addressed under the USEPA RCRA 3008(h) Consent Order. This Order requires Solutia to stabilize migration of contaminated groundwater at or from the Facility by 1/1/2002.

The meeting ended by Solutia agreeing to supply a formalized plan and draft schedule to the Agency within the following week.

cc: Collinsville Region
Chris Perzan
Terri Blake Myers

ATTENDANCE RECORD

Date 1-25-01

Subject Solutia

NAME	AFFILIATION	TELEPHONE
Nick Mahlandt	IEPA - Bur. of Water	346-5120
Tony Mellini	URS	414 831-4110
Guy Steensgard	Solutia - WGK	(618) 482-6345
KEN MENSING	IEPA - BUREAU OF LAND	346-5170
John Justice	IEPA / BOA	" "
Alan Faust	Solutia	482-6538
Don Ridenhower	Solutia	618-482-6444
CRAIG KOZICKI	SOLUTIA	(618) 482-6557
Mark Schuster	IEPA BOA	618/346-5120
Gina Search	IEPA BOL	618/346-5120
Chris Cahnovsky	IEPA BOL	618/346-5120
Robert J. Hiller	Solutia - WGK EGH	(618) 482-6362
Anthony Dulka	IEPA/BOW	217/785-4787
Tom [illegible]	IEPA - [illegible]	618/[illegible]

AGENDA IEPA/SOLUTIA

ATTENDEES:	**Alan Faust**	**ESH Lead**
	Craig Kozicki	**Business Team Lead**
	Guy Steensgard	**Department Engineer**
	Don Ridenhower	**Communications**
	Robert Hiller	**Environmental Specialist**
	Anthony Mellini	**URS**

I. Incident Overview

II. Investigation Overview

III. Exploration

IV. Potential Remedies

V. Communicatons

VI. Path Forward

W. G. Krummrich Plant
Incident No. [0101]

Date Of Incident	**1/7/01 16:53 - 1/8/01 06:12**
Location	**Monochlorobenzene Department - Catalyst Tank (Item 210), Area Drains, and the Collection Sump**
Type Of Incident	**Chemical release**
Nature Of Injury	**None**
Cause[s]	**The catalyst addition procedure was not followed.**
Investigating Committee	**Guy Steensgard** **Duke Hinrichs** **Kevin Eversman** **Kyle Kohlhaas** **Ron Schrenker** **Brent Gilhousen**
Review With Plant Manager	**1/11/01 & 1/18/01**

Approvals:

G. T. Steensgard 1/24/01
Committee Chairperson

Affected BTL

Plant Manager

Committee Formed:	**1/8/01**
Plant Manager Review:	**1/11/01**
Published:	**1/24/01**

Incident Statement

On Sunday, January 7, 2001, a flush valve was left open following a routine catalyst addition procedure. As a result, monochlorobenzene (MCB) filled the catalyst addition hopper, and subsequently overflowed to the pad below the Catalyst Tank (Item 210). The MCB flowed into the department's area drain. While some of the material reached the Collection Sump and was pumped to the Rainwater Tank (Item 947), most escaped the area drain/sump system to the ground around the Collection Sump area.

When the problem was discovered, actions were taken to immediately isolate the source, recover the MCB, and initiate agency notification.

Incident Description

Early on middle shift on Sunday, January 7, 2001, the outside MCB Unit Controller was working with mechanics on the Benzene/Water Separator (Item 187). Shortly before 5:00 PM (while the mechanics were getting parts for the 187 work), he charged the Catalyst Tank (Item 210). The catalyst addition part of this procedure is strictly a field operation requiring the systematic opening and closing of several manual valves. The unit controller opened both catalyst addition valves (See Figure 1 - V5 & V6), verified that the vent eductor's nitrogen valve (V4) was open, and charged the appropriate amount of catalyst into the tank. The charge chute was then flushed by opening valves V2 and V7 (V3 is normally open). The hopper was also flushed by opening V1 and flushing through the attached hose. When the flush was complete, the unit controller closed V1 and V6. Valves V2, V4, V5, and V7 remained open. As the unit controller was leaving the area, he radioed to the control room that it was OK to fill the Catalyst Tank. The MCB flow from the MCB Recycle Tank (Item 521) to the Catalyst Tank started at 4:53 PM (time verified by the department's data historian system).

MCB continued to flow through the flush valves, filling the charge chute and hopper, and overflowing to the concrete pad below the tank. The material made its way to the area drain (designed to recover storm water and spills) and flowed to the Collection Sump.

The Collection Sump level started to rise at 6:36 PM and the Collection Sump Pump started automatically when the level reached 70% at 7:44 PM. The level quickly dropped about 12% as the liquid was pumped to the Rainwater Tank (Item 947), then gradually rose. The inside MCB Unit Controller noticed that the level reached 75% (high level alarm sounded), and he opened the level control valve, LC182-2 at 9:40 PM. The level once again quickly dropped, this time to 30%, then the pump shut off and the unit controller closed LC182-2. The level once again began to rise, and the Collection Sump Pump restarted 24 minutes later. The pump continued to run through the night keeping the level within its normal operating range.

The Catalyst Tank operated normally throughout the night, maintaining flow to the #1 Chlorinator (Item 220) at the desired 210 level drop rate of 5% per hour. During this same time, the MCB Recycle Tank rose at a rate of 3.7% per hour. This is not consistent with its normal operation where its level alternates between rising at ~31% per hour and falling at ~20% per hour. The levels of the MCB Storage Tanks (Items 514 and 515) did not rise during this time (compared to a typical 2-3% per hour rise).

As the day shift began, the inside MCB Unit Controller realized that the level in the MCB Recycle Tank was not rising as fast as normal and that the levels in the MCB

Storage Tanks (Items 514 and 515) had not gone up for a long time. Other Unit Controllers were directed to these areas where they found MCB overflowing the catalyst hopper and the hopper vent stack.

The Unit Controllers closed valves V2, V4, V5, and V7. They immediately began clean-up efforts by soaking the MCB up with blue adsorbent cloth. The Collection Sump level dropped sharply and the pump shut off. They began flushing the sewer with water. The level in the Collection Sump began to rise, the Collection Sump Pump was started, and the level was controlled per normal operation. The reaction of the Collection Sump Pump was an indication that the Area Drain and Collection Sump were intact, and it was assumed that they were functioning properly.

The unit controllers called the Night Superintendent around 6:30 AM. Supervision arrived at the department, evaluated the situation at the release site, and based on uncertainty of quantity and evaporative losses, decided to call the Release Coordinator and begin regulatory notification. The Release Coordinator was contacted at ~7:00 AM, and the Night Superintendent started to place calls to the agencies around 7:15 AM.

An engineering investigation into the event was started around 8:00 AM. Material balance calculations were performed to determine the amount of MCB that left the process piping/equipment and the amount that was recovered from containment systems. This investigation revealed that ~10,800 gallons of MCB left the process. Of that, approximately 2,400 gallons were recovered from the Area Drain/Collection Sump system and transferred to the Rainwater Storage Tank (Item 947).

Efforts then focused on where the additional MCB had gone. Evaporative losses were roughly estimated and determined to not to be the bulk of the losses. The Area Drain and Collection Sump were studied to determine the extent of repairs required. An inactive part of the Collection Sump was inspected, and samples of liquid from this area revealed the presence of a significant amount of MCB. This material was recovered by pumping it to the Wastewater Surge Tank (Item 950). This tank had been out of service. Its vent was reconnected to the department vent header prior to pumping material into it. Measurements of the organic level in the tank indicate that 1,400 gallons of MCB was recovered. This was complete by Monday evening.

The entire Area Drain system was visually inspected using a remote controlled video camera. In addition, it was also hydrostatically tested. Area drain repairs have been identified and a plan has been implemented. Actions to explore subsurface soils for MCB and develop plans to recover it were also started at this time.

99.9% MCB - confident estimate

Evidence

1. Based on process data, it is estimated that 10,700 gallons of MCB exited the process equipment at the Catalyst Tank.

2. Based on process data, it is estimated that 2,400 gallons of MCB was recovered in the MCB Rainwater Tank via the Collection Sump.

3. Based on field measurements taken by department personnel, it is estimated that 1,400 gallons of MCB was recovered from the inactive part of the Collection Sump.

4. Subsequent inspection of the area drain/sump system revealed that the seal had deteriorated at the outgoing joint at #4 junction box in the pump alley north of the Collection Sump.

coming into the sidewall - evidence that MCB was in subsurface.

5. Net environmental losses are calculated to be:

Surface evaporation	80 Gallons	700 pounds
Vent losses	280 Gallons	2,400 pounds
To Subsurface	6,700 Gallons	58,000 pounds

6. Environmental conditions during this event were as follows:

Wind Speed	10 MPH Avg.	23 MPH Peak
Wind Direction	Slightly north of northwest (322° Avg.)	
Temperature	32 °F Avg.	43 °F Max

Causes:

1. The catalyst addition procedure was not followed.
2. Area surveillance and process monitoring by the MCB Unit Controllers (on middle and late shifts) was inadequate.
3. There was a deterioration of the seal of the outgoing joint at #4 junction box in the pump alley north of the Collection Sump.

Findings and Accountable Person

1. Until initial corrective action is taken, provide around-the-clock supervision to ensure area surveillance is maintained, and implement spill containment measures to minimize the risk of process materials entering the area drains.
   Accountable: Craig Kozicki
   Responsible: MCB FLS and Engineers
   EDC: Complete
2. Complete determination of spill quantity.
   Accountable: Craig Kozicki
   Responsible: Guy Steensgard
   EDC: Complete
3. Perform exploration sampling in area to determine the location and extent of soil contamination.
   Accountable: Alan Faust
   Responsible: Bob Hiller
   EDC: Complete
4. Evaluate 911 notification procedures to insure local communications.
   Accountable: Alan Faust
   Responsible: Don Ridenhower
   EDC: Complete
5. Evaluate the catalyst charging procedure and retrain all MCB operating personnel.
   Accountable: Craig Kozicki
   Responsible: Kevin Eversman
   EDC: 1/31/01

6. Evaluate automation of MCB flush at the Catalyst Tank.
   Accountable: Craig Kozicki
   Responsible: Kyle Kohlhaas
   EDC: 2/15/01

7. Upgrade MCB walkthrough procedures to be more rigorous and formalized.
   Accountable: Craig Kozicki
   Responsible: C/B FLS
   EDC: 2/15/01

8. Evaluate MCB operator training/tools to enhance analytical troubleshooting skills.
   Accountable: Robin Prokop
   Responsible: Craig Kozicki
   EDC: 3/31/01

9. Re-evaluate/initiate accountability and expectations with MCB personnel and Night Supervision.
   Accountable: Robin Prokop
   Responsible: Craig Kozicki
   EDC: 3/31/01

10. Inspect area drain/sump system. Develop and implement corrective action plan based on findings.
    Accountable: Craig Kozicki
    Responsible: Ron Schrenker
    EDC: 1/31/01

11. Conduct analysis of outgoing sewer joint of junction box #4.
    Accountable: Craig Kozicki
    Responsible: Ron Schrenker
    EDC: 1/31/01

12. Develop and implement a plan to ensure continuing mechanical integrity of the MCB drain/sump system.
    Accountable: Craig Kozicki
    Responsible: Ron Schrenker
    EDC: 2/15/01

13. Develop plan to maximize MCB recovery.
    Accountable: Alan Faust
    Responsible: Bob Hiller
    EDC: 1/31/01

14. Communicate investigation findings to all departments within the plant.
    Accountable: Robin Prokop
    Responsible: Craig Kozicki
    EDC: 2/15/01

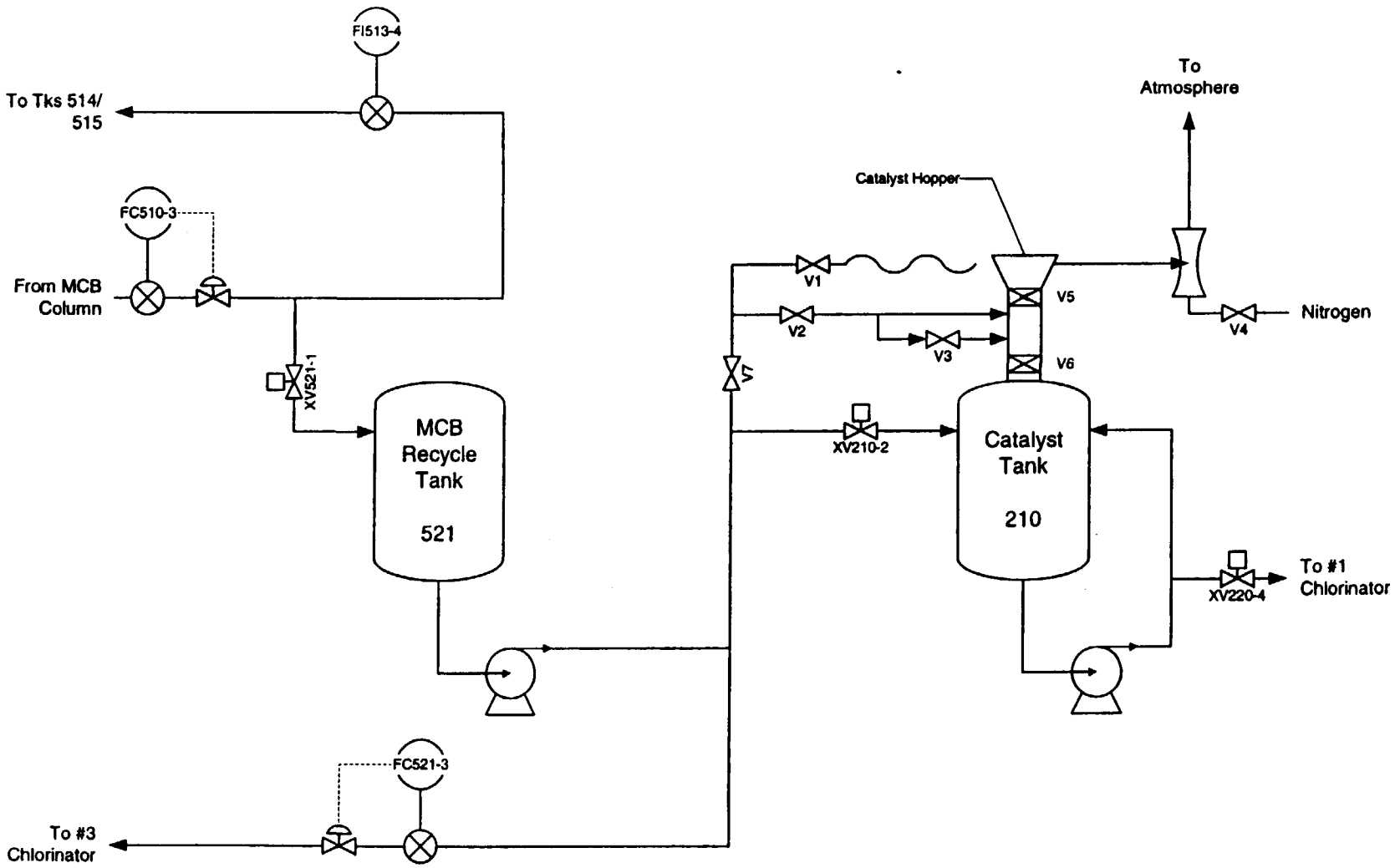

Figure 1: Simplified Piping and Instrument Diagram - MCB Recycle Tank and Catalyst Tank

SOLUTIA

Applied Chemistry, Creative Solutions

Solutia Inc.
W.G. Krummrich Plant
500 Monsanto Avenue
Sauget, Illinois 62206-1198
Tel 618-271-5835

January 12, 2001

Richard Karl,
Chief, Emergency Response Branch
USEPA Region V
77 West Jackson Blvd.
Chicago, IL 60604

CERTIFIED 092 044 939
RETURN RECEIPT REQUESTED

Re: NRC Case No. 552888

Dear Mr. Karl:

On January 8, 2001, Solutia Inc.'s ("Solutia") W.G. Krummrich Plant made a "provisionary" call to the National Response Center ("NRC") at approximately 7:30 AM, concerning a release incident. We reported that chlorobenzene was released from our MCB ("Monochlorobenzene") department. We further reported that the release appeared to result from a valve being left open and that material had flowed to a diked area/tank. Finally, we reported that the flow to the diked area had stopped, but that we were not yet certain as to the quantity or the extent of release to the environment. Ms. Verneta Simon from your staff called at approximately 7:55 AM to ask about proximity to the nearest resident, and the size of the dike area. The message was not clearly understood, and we spoke with Ms. Simon later in the day. We described the incident, and she indicated she would make a note of the conversation in the record.

Upon completion of additional investigation on January 9, 2001, it was determined that a release to the environment had occurred. Solutia immediately notified the NRC to provide this updated information. Mr. John Maritote answered the phone, and requested that this update be communicated to you. I left a message for Ms. Simon on January 9, 2001 at approximately 3:30 PM, stating that the incident resulted in excess of 40,000 pounds of chlorobenzene to the environment. We spoke further on the incident on January 11, 2001.

Our investigation has estimated that chlorobenzene was released to the environment in amounts in excess of its "reportable quantity" ("RQ") amounts, as follows: 58,000 pounds of chlorobenzene to the subsurface; 3,000 pounds of chlorobenzene to the air. The RQ for chlorobenzene is 100 pounds.

Solutia responded to this release in an expeditious and timely manner. Our inspection of the area drain/sump system has identified a sewer joint failure. This has been repaired. An exploratory program is underway to attempt to identify the location of the spilled material and design a recovery system.

Please contact Richard Hampel (618-482-6549) at the plant if you have any additional questions.

Sincerely,

Alan G. Faust
ESH Team Lead

SOLUTIA

Applied Chemistry. Creative Solutions

Solutia Inc.
W.G. Krummrich Plant
500 Monsanto Avenue
Sauget, Illinois 62206-1198
Tel 618-271-5835

January 12, 2001

CERTIFIED MAIL # 092 044 937
RETURN RECEIPT REQUESTED

Mr. Jim Sullivan
Illinois Emergency Management Agency
110 East Adams Street
Springfield, IL 627067

RE: Incident # H2001-0038

Dear Mr. Sullivan:

On January 8, 2001, Solutia Inc. verbally reported a release of chlorobenzene from the W.G. Krummrich Plant located in Sauget, Illinois (reference Illinois HazMat Report Incident No. H2001-0038). We reported that the material was from our MCB ("Monochlorobenzene") department, and that we were not yet certain as to the quantity or the extent of the release to the environment. We further stated that we believed the material was released from a pipe, via a valve left open. Our investigation has estimated that chlorobenzene and the estimated quantities, were released to the environment in amounts in excess of their respective "reportable quantity" ("RQ") amounts, as follows: 58,000 pounds of chlorobenzene to the subsurface; 3,000 pounds of chlorobenzene to the air. This is the follow up written notice of the release from our Monochlorobenzene manufacturing operations.

1. **The chemical name or identity of any substance released and if material is an extremely hazardous or CERCLA substance:** A chemical release of chlorobenzene occurred from our Monochlorobenzene manufacturing operations. The CAS number for this material is 108-90-7. Chlorobenzene is not an extremely hazardous substance, and has a CERCLA RQ of 100 pounds.

2. **An estimate of the quantity in pounds of any such substance that was released into the environment, and location of the release:** It is estimated that approximately 58,000 pounds of chlorobenzene to the subsurface and approximately 3,000 pounds of chlorobenzene to the air, were released from our MCB ("Monochlorobenzene") department.

3. **The time and duration of the release:** The release occurred at approximately 4:53 PM on Sunday, January 7, 2001, and was discovered and controlled at approximately 6:12 AM on Monday, January 8, 2001.

4. **Specific location of the release, and the medium or media (air, water, land) into which the release occurred:** See No. 2 above.

5. **The date and time of the notification to the IEMA and local emergency management agencies:** On January 8, 2001, the following notifications were made: the local emergency response agencies for St. Clair County, East St. Louis, and St. Clair County were contacted at 7:15 AM. The Illinois ESMA was notified at 7:18 AM (Report # H2001-0038). The National Response Center was notified at 7:31 AM (Report # 552888).

   The following notifications were made with updated information concerning the amount of material released. On January 9, 2001, the Illinois IEMA was notified at approximately 3:35 PM. You were not available and we were requested to call back in the morning. We subsequently made contact on January 10, 2001 at approximately 8:40 AM. On January 9, 2001, the National Response Center was notified at 3:30 PM and referred us to USEPA Region V Emergency Response Branch. We left a message on the associated answering system. The local emergency response agencies for St. Clair County, East St. Louis, and St. Clair County were contacted between approximately 4:15 - 4:18 PM. Various follow-up calls were also made with these emergency response agencies on the morning of January 10, 2001.

6. **A contact person and telephone number for further notification:** Please direct any questions regarding this incident or notice to Richard B. Hampel, Solutia Inc., 500 Monsanto Ave., Sauget, IL 62206-1198. Phone (618) 482-6549.

7. **Describe the on-site and off-site areas affected by this release:** The department was operating in a normal manner. On Sunday January 7, 2001, a flush valve remained open following a routine catalyst addition procedure. Chlorobenzene filled the catalyst addition hopper, and overflowed to the pad below the Catalyst Tank (Item 210). The chlorobenzene flowed into the area drain/sump system. This system pumped material to another vessel for recovery. Our investigation has determined that an apparent breach in the area drain/sump system resulted in a release to the subsurface. The air release was a result of evaporation from the surfaces of the tank, its pad, and other associated equipment, and also from other paved surfaces within the department. No off-site areas are believed to be affected by this release.

8 **Actions taken to respond to and contain the release:** Discovery of the release was made at approximately 6:00 AM Monday January 8, 2001. Solutia personnel obtained appropriate personal protective equipment and began to assess the situation. Various valves were closed at approximately 6:12 AM, effectively isolating the source of the material. Operations personnel immediately began clean-up efforts by adsorbing the liquid material with adsorbent pads, and flushing the associated department sewer with water to the sump system. The sump system responded as expected, indicating the area drain/sump system was intact and functioning properly. Operations personnel notified our Night Superintendent at approximately 6:30 AM, and upon further evaluation of the release site by Supervision including the first attempt to estimate release quantities, provisional notifications to the agencies were immediately made. These notifications began at approximately 7:15 AM. An exploratory program is underway to attempt to identify the location of the spilled material and design a recovery system. Our inspection of the area drain/sump system has identified a sewer joint failure. This has been repaired.

9. **Any known or anticipated acute or chronic health risks associated with the release, and where appropriate, advice regarding medical attention necessary for exposed individuals:** Solutia is unaware of any acute or chronic injuries or health risks resulting from this release. Solutia personnel responding to the release wore proper Personal Protective Equipment.

Sincerely,

Alan G. Faust
ESH Team Lead

cc: Mr. Darrell Elbe, St. Clair County ESDA, Certified Mail # 7099 3400 0004 6721 0219
Mr. George Foster, East St. Louis ESDA, Certified Mail # 7099 3400 0004 6721 0127
Mr. John Hainline, Cahokia ESDA, Certified Mail # 7099 3400 0004 6721 0189
Mr. Tod Rowe, Manager Emergency Response Unit, IEPA, Certified Mail # 092 044 938
Mr. Tom Powell, Collinsville IEPA, Certified Mail # 7099 3400 0004 6721 0158

AGENDA IEPA/SOLUTIA

ATTENDEES:	**Alan Faust**	**ESH Lead**
	Craig Kozicki	**Business Team Lead**
	Guy Steensgard	**Department Engineer**
	Don Ridenhower	**Communications**
	Anthony Mellini	**URS**

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URS

Construction Services

2-PHASE™ EXTRACTION SYSTEM

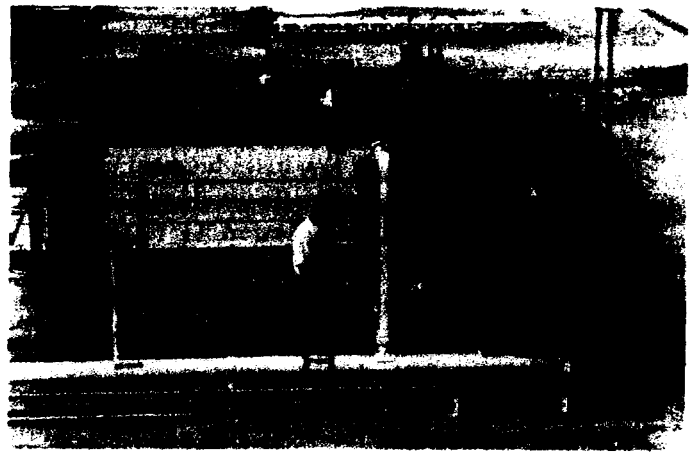
Today, Remedial Project Managers must spend their remediation dollars wisely. Pumping and treating groundwater contamination is no longer enough. This old method is too expensive and not effective. A remediation technique needs to cleanup contamination, not just contain it.

At URS, we believe technology combined with our know-how, sets us apart and makes you more competitive in the marketplace. That is why one of our top priorities is the development and application of new technologies—a commitment to innovation that encouraged our scientists and engineers to immediately recognize the benefits of the 2-PHASE™ Extraction system. We quickly saw this technology as a way to help our clients reduce their costs and risks, and so became the first full licensee of the 2-PHASE™ Extraction system.

What is 2-PHASE™ Extraction

Patented by the Xerox Corporation and enhanced by URS, 2-PHASE Extraction uses a high vacuum to remove contaminants from above and below the water table simultaneously. The name comes from the two phases of contaminants the system extracts: both aqueous phase (in the groundwater) and vapor phase (in the soil vapor above the water table). A 2-PHASE™ system lowers the water table around the well, exposing more of the information. Contaminants in the newly exposed vadose zone are then accessibly to vapor extraction, which can remove contamination more efficiently than pump-and-treat.

Because the 2-PHASE™ Extraction system depresses the water table and uses a high vacuum, water flows faster to the extraction well. The high vacuum used on the soils means greater vapor flow through the soils and faster removal of contaminants.



The skid-mounted 2-PHASE™ unit at McClellan AFB was easily retrofitted onto an existing extraction and treatment system.

Once the extracted water and vapor are brought to the surface, they are treated separately. Due to turbulence created during extraction, most of the contaminants in the water are stripped away and additional treatments are unnecessary. The contaminants, now in the vapor, are treated by a more cost-effective method, depending upon the constituents. The result is a simpler system that needs less equipment than conventional methods.

URS obtained one of the first licenses to use 2-PHASE™ Extraction from Xerox and was invited to conduct the demonstration test at McClellan AFB. URS has already successfully used 2-PHASE™ Extraction at many sites across the country. The results of the pilot-scale test at McClellan are typical of the 2-PHASE™ Extraction's performance.

Leaders in applying the 2-PHASE™ Extraction

Our real-world experience puts us ahead of any other organization and allows us to bring real value-added results to our clients. For instance, pilot tests are helpful, but they are not always necessary. With sufficient site data, URS engineers bypass the pilot stage and go directly into full-scale design and construction, saving time and money.

URS Corporation
Milwaukee County Research Park
10200 Innovation Drive, Suite 500
Milwaukee, WI 53226
Tel: 414.831.4100
Fax: 414.831.4101

Four of our clients' successes with the 2-PHASE™ Extraction system are highlighted below.

McClellan Air Force Base, California

Groundwater contaminated with chlorinated solvents and Freon® had been migrating toward a primary water supply well. For several years, a groundwater pump-and-treat system had been used to control the plume, but high costs and low mass removal had the Air Force looking for a more effective solution. URS presented the 2-PHASE™ system to Air Force and regulatory officials. The EPA and the Air Force contracted us to implement a 2-PHASE™ system at McClellan AFB—one of the Defense Department's National Test Centers. This demonstration of the 2-PHASE™ technology was conducted as part of the EPA Superfund Innovative Technology Evaluation (SITE) program in support of a project by the Clean Sites Public-Private Partnership. After only one month, the 2-PHASE™ system had removed more contaminant mass than the pump-and-treat system had during its entire five-year operation. Groundwater recovery rates increased 150%, mass removal rate of contamination increased twelvefold, and the cost per pound of contaminant removed dropped by 90%, reducing remedial costs to $28/lb.

Xerox CRC Facility, Georgia

For about four years, a Xerox facility had been operating a groundwater collection system composed of 17 pumping wells. The system had removed 63 million gallons of water and 60 pounds of contaminants. URS placed a 2-PHASE™ system on line to operate in conjunction with the existing groundwater extraction system. The 2-PHASE™ system removed more than 560 pounds of contaminants in its first two weeks of operation and nearly 1900 pounds in the first five months.

Confidential Manufacturing Facility, New York

A large manufacturing facility in operation since the 1950s had disposed used solvents in unlined evaporation pits. As a result, various solvents have been detected in soils and groundwater in several areas of the facility. URS performed 2-PHASE™ pilot tests at the facility with one of our 2-PHASE™ mobile pilot test trailers. Results indicated that the 2-PHASE™ is giving our client what they want—hydraulic control of on-site groundwater and minimization of risk. We are currently designing the full-scale system and enhancing their system with the following features:

- Vapor treatment through catalytic oxidation,
- Groundwater treatment through fluidized-bed biological treatment, and
- Multiple treated-water discharge points, including sewer discharge, surface water discharge (with an SPDES permit), groundwater reinjection into source areas, and drip irrigation.

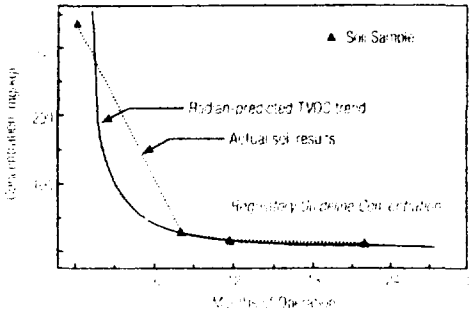
Xerox Manufacturing Facility, Mississauga, Canada

Site investigations of an area used for equipment refurbishing operations revealed localized soil and groundwater contamination as a result of chemical releases from underground storage tanks and solvent spray booths. As an alternative to the more expensive approach of soil excavation, treatment, and disposal, a 2-PHASE™ system began operation. Within 2 years of operation, over 3000 pounds of contaminant mass had been removed. Recent subsurface soil testing results show that VOC concentrations have been reduced by more than 95%. This site, along with a similar site in Calgary, closed ahead of schedule after only 2 years of active remediation. The speed and thoroughness of the cleanup would not have been possible using other techniques.

Demonstrated Site Closure Experience

Two sites where URS managed 2-PHASE™-based remediation projects have been closed to the satisfaction of both landowners and regulatory agencies. 2-PHASE™ Extraction was chosen in lieu of expensive excavation/disposal or unreliable pump-and-treat/SVE in order to meet aggressive business priorities.

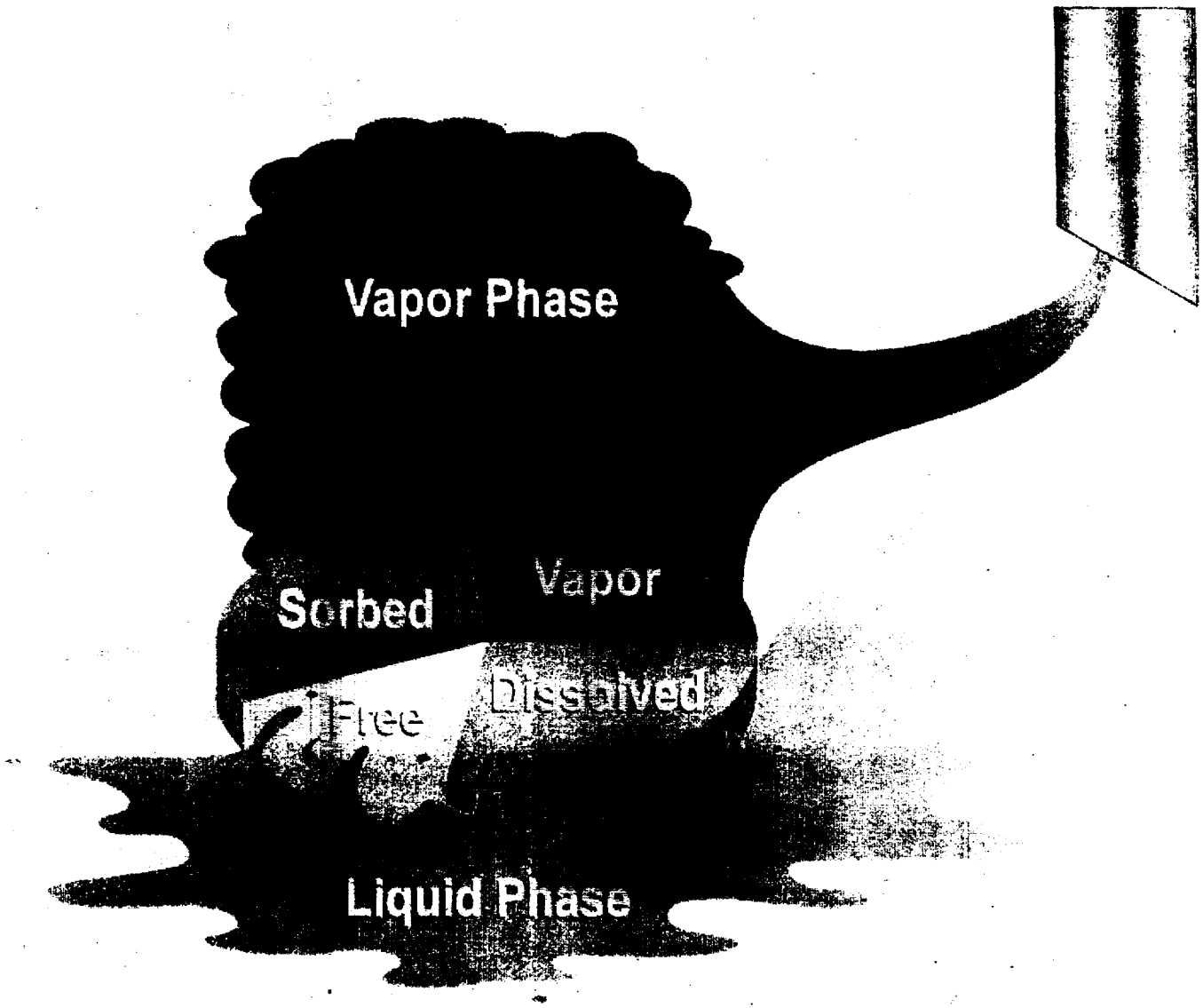
The chart below illustrates how URS predicted cleanup rates and achieved the regulatory objectives at one of these sites. URS designed and operated the ™ system to meet both cleanup endpoints and deadlines. All goals were achieved and, within two years of operation kickoff, the site was closed several months ahead of schedule.



URS

2-PHASE™ EXTRACTION

2-PHASE™ EXTRACTION



What Is 2-PHASE™ EXTRACTION?

- How Does It Work?
  - High Vacuum (19 to 25 Inches of Hg) Applied to Well
  - Groundwater and Soil Vapors Drawn Simultaneously Into Well
  - Groundwater Removed Through Entrainment In Vapor Stream
  - Recovered Water and Vapor Are Separated and Treated Above Ground
  - Increases Groundwater Recovery by 2 to 10 Times
  - Improves Migration Control
  - Purposefully Induces Artificial Unsaturated Zone

2-PHASE™ EXTRACTION

URS

Advantages and Disadvantages of 2-PHASE™ EXTRACTION

Advantages

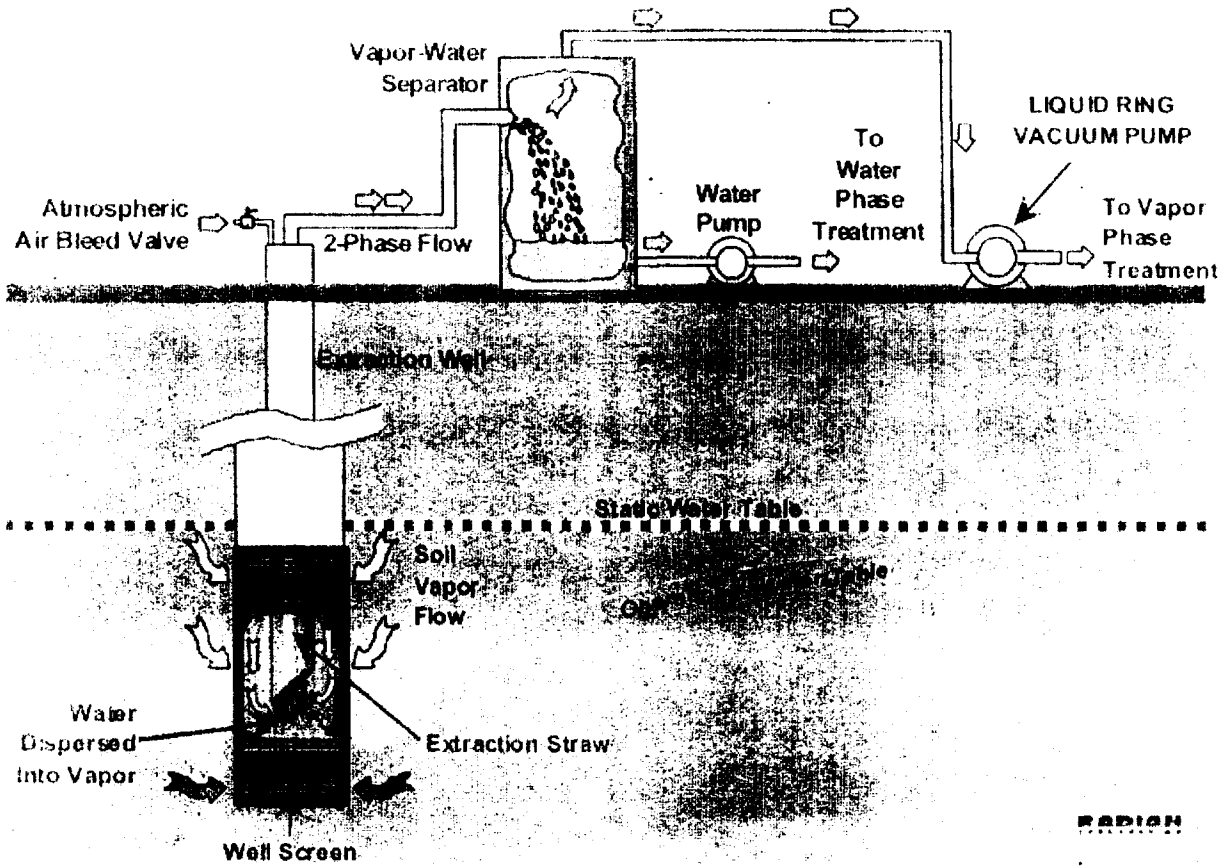
- Proven Performance in Low-Permeability Soils. Requires No Downhole Pumps
- Minimal Disturbance to Site Operations
- Substantially Increases Free Product and Groundwater Extraction Rates
- Can be Used Under Buildings and Other Locations that Can not be Excavated
- Concentrates and Pre-Treats Vapors to Optimize Treatment Efficiency
- Simple, Rugged, Reliable Hardware

Disadvantages

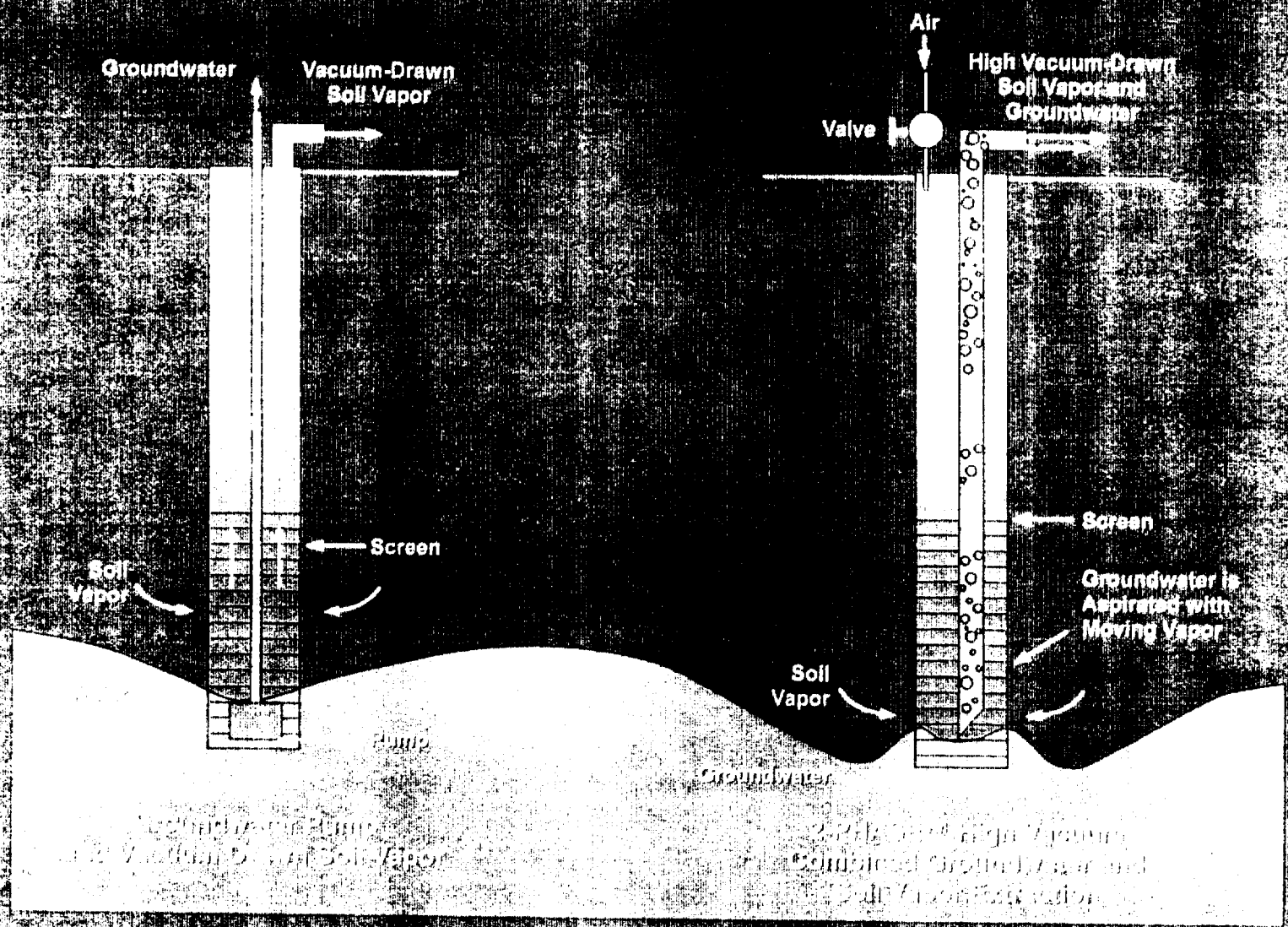
- Can Extract a Large Volume of Groundwater That May Require Treatment
- Requires Monitoring and Control During Operation

How Does 2-Phase Work?

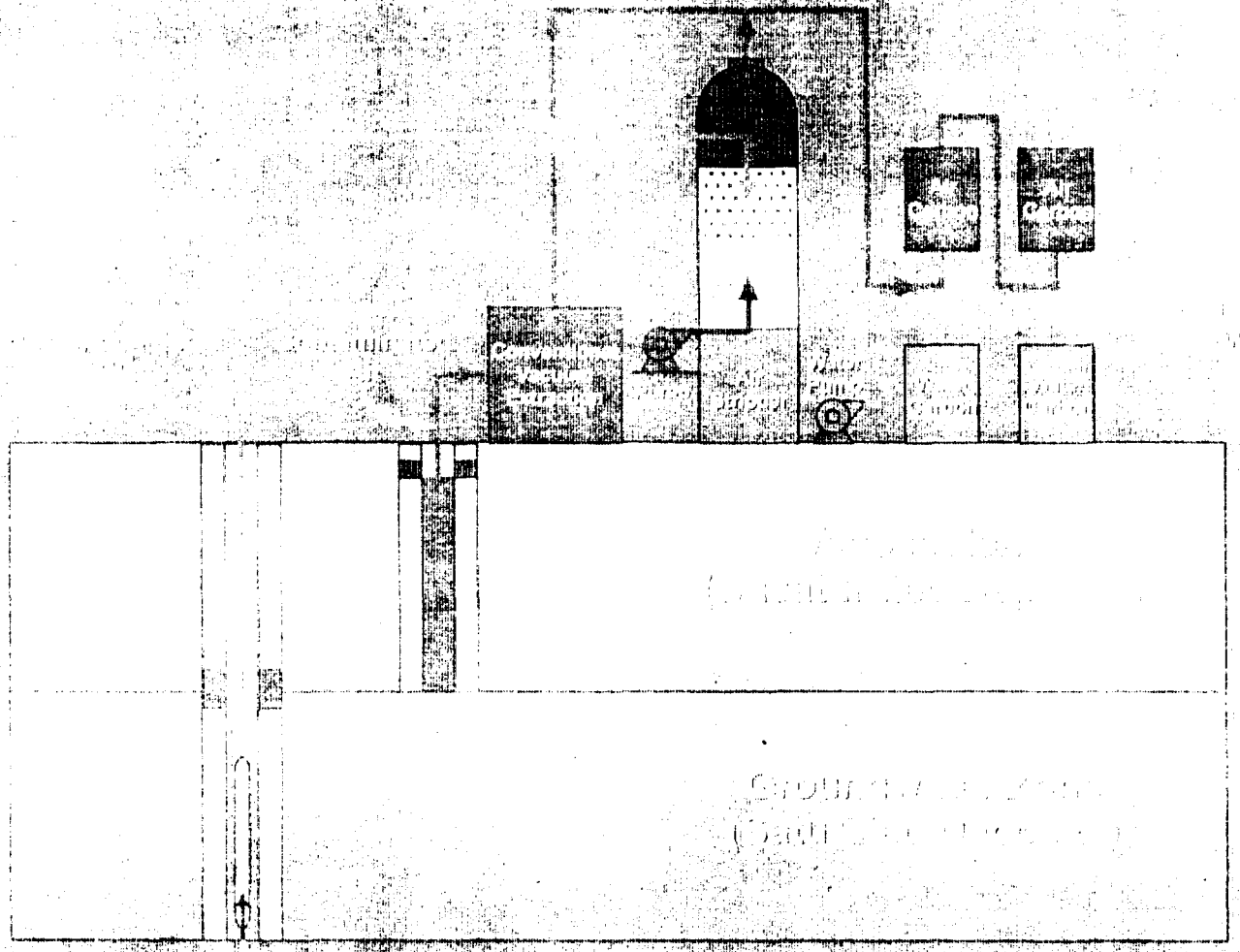
2 PHASE



Examples of In-Situ Extraction Methods



Conventional Remediation System



2-PHASE™ EXTRACTION

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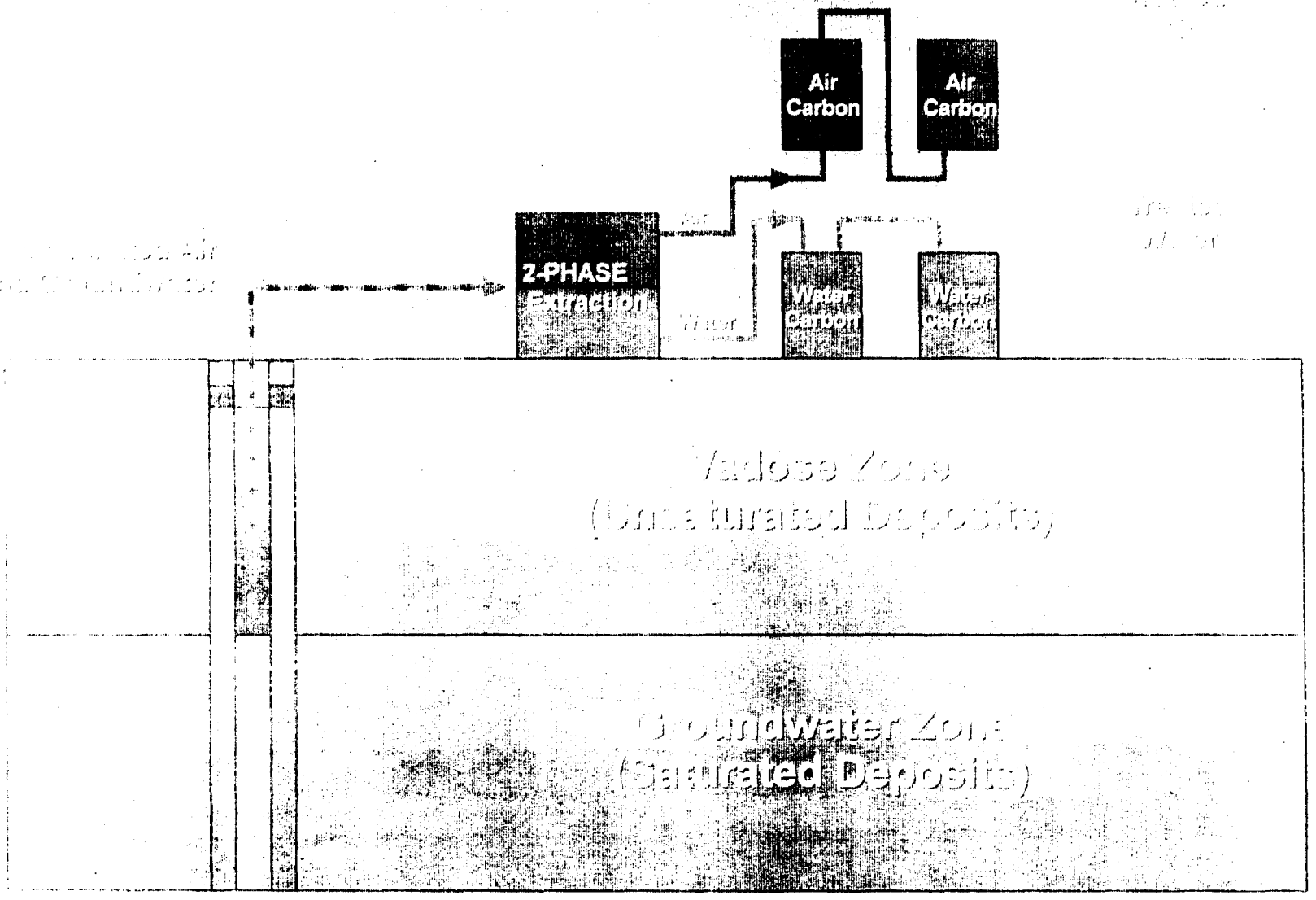
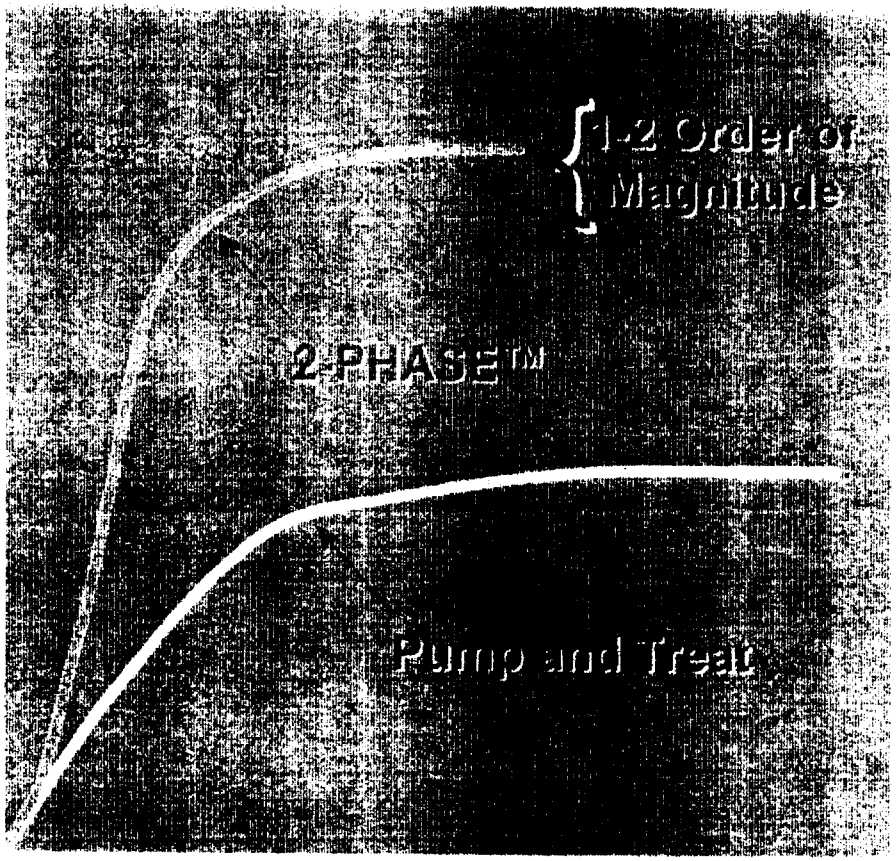
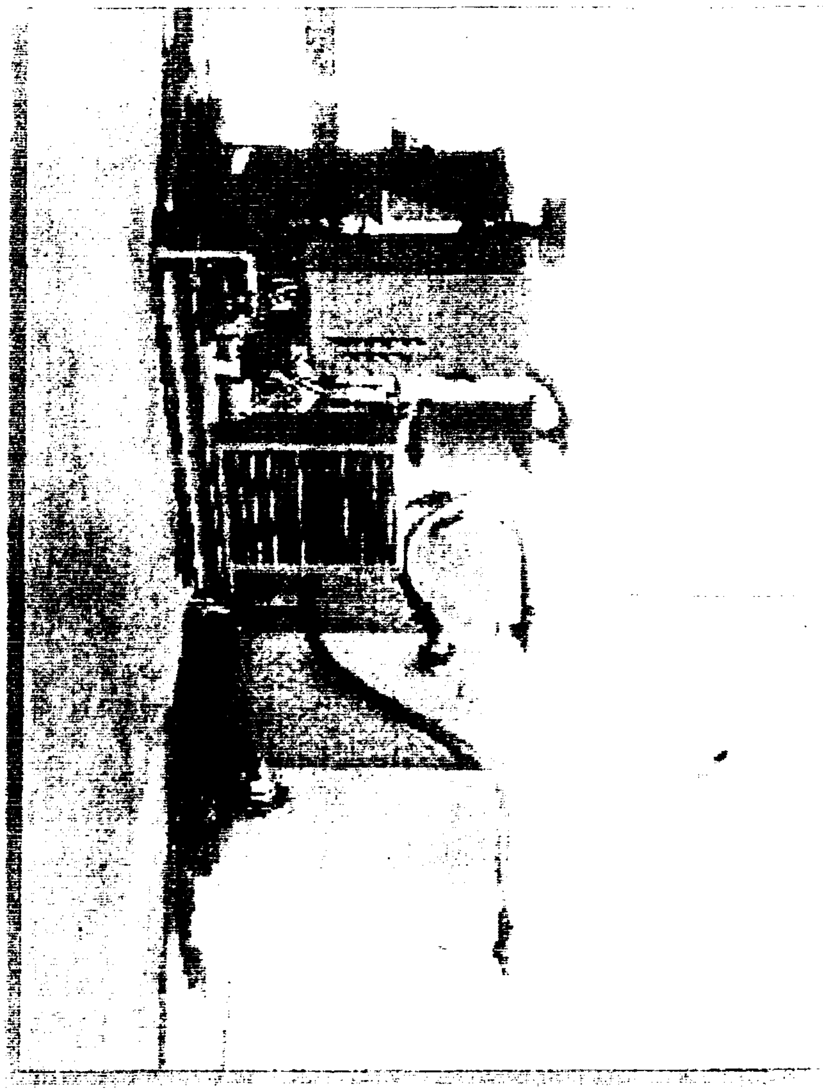
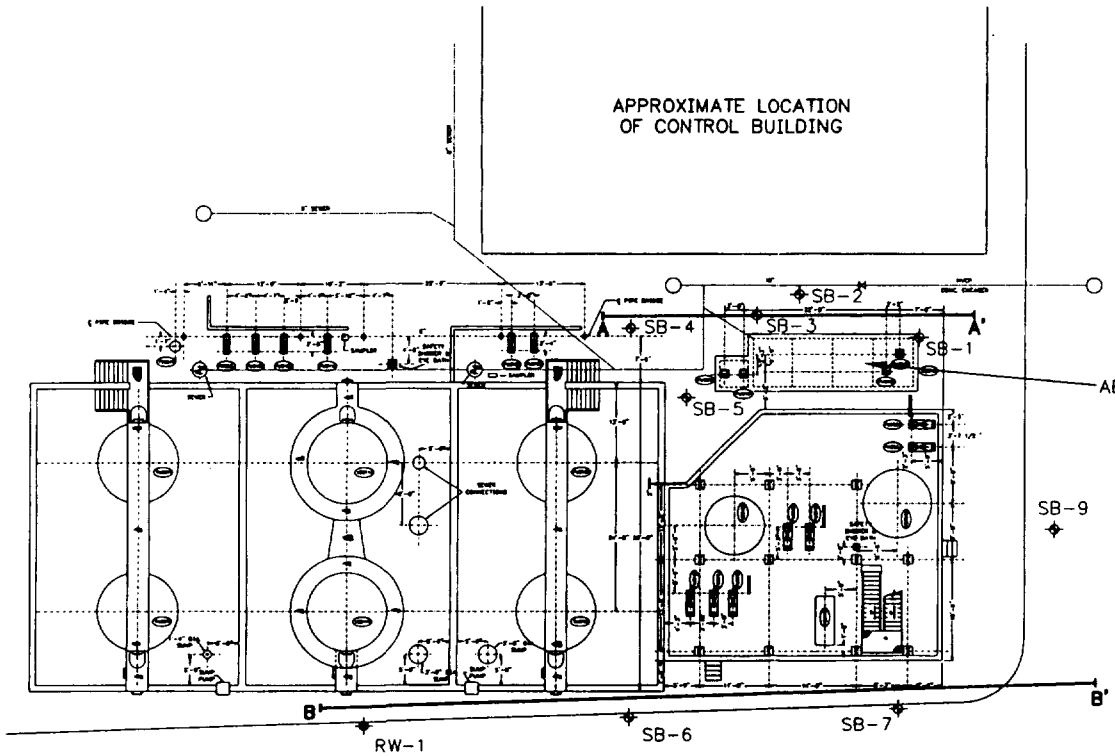


2-PHASE™ EXTRACTION







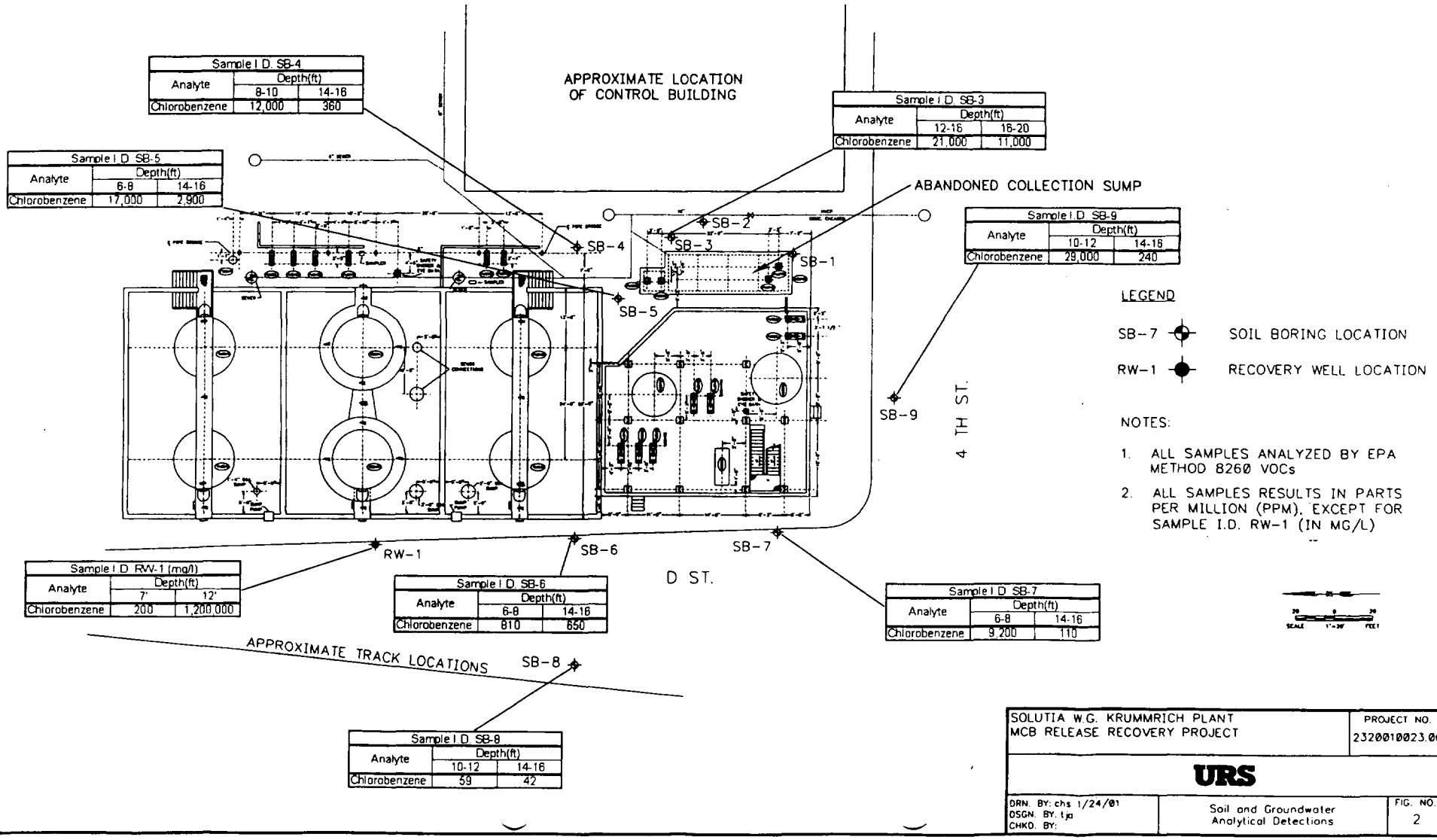
LEGEND

SB-7	SOIL BORING LOCATION
RW-1	RECOVERY WELL LOCATION
A-A'	CROSS SECTION PROFILE

SCALE 1"=20' FEET

SOLUTIA W.G. KRUMMRICH PLANT MCB RELEASE RECOVERY PROJECT	PROJECT NO. 23200100023.00
URS	
DRN. BY: chs 1/24/01 DSGN. BY: ljo CHKD. BY:	MCB Release Piezometers & Monitoring Well Locations — FIG NO 1

File: F:\23200100023.00\FIG1.DWG last edited JAN 24, 01 @ 7:28 a.m. by IRS Corp



Sample I.D. SB-4		
Analyte	Depth(ft)	
	8-10	14-16
Chlorobenzene	12,000	360

Sample I.D. SB-3		
Analyte	Depth(ft)	
	12-16	16-20
Chlorobenzene	21,000	11,000

Sample I.D. SB-5		
Analyte	Depth(ft)	
	6-8	14-16
Chlorobenzene	17,000	2,900

Sample I.D. SB-9		
Analyte	Depth(ft)	
	10-12	14-16
Chlorobenzene	29,000	240

Sample I.D. RW-1 (mg/l)		
Analyte	Depth(ft)	
	7'	12'
Chlorobenzene	200	1,200,000

Sample I.D. SB-6		
Analyte	Depth(ft)	
	6-8	14-16
Chlorobenzene	810	650

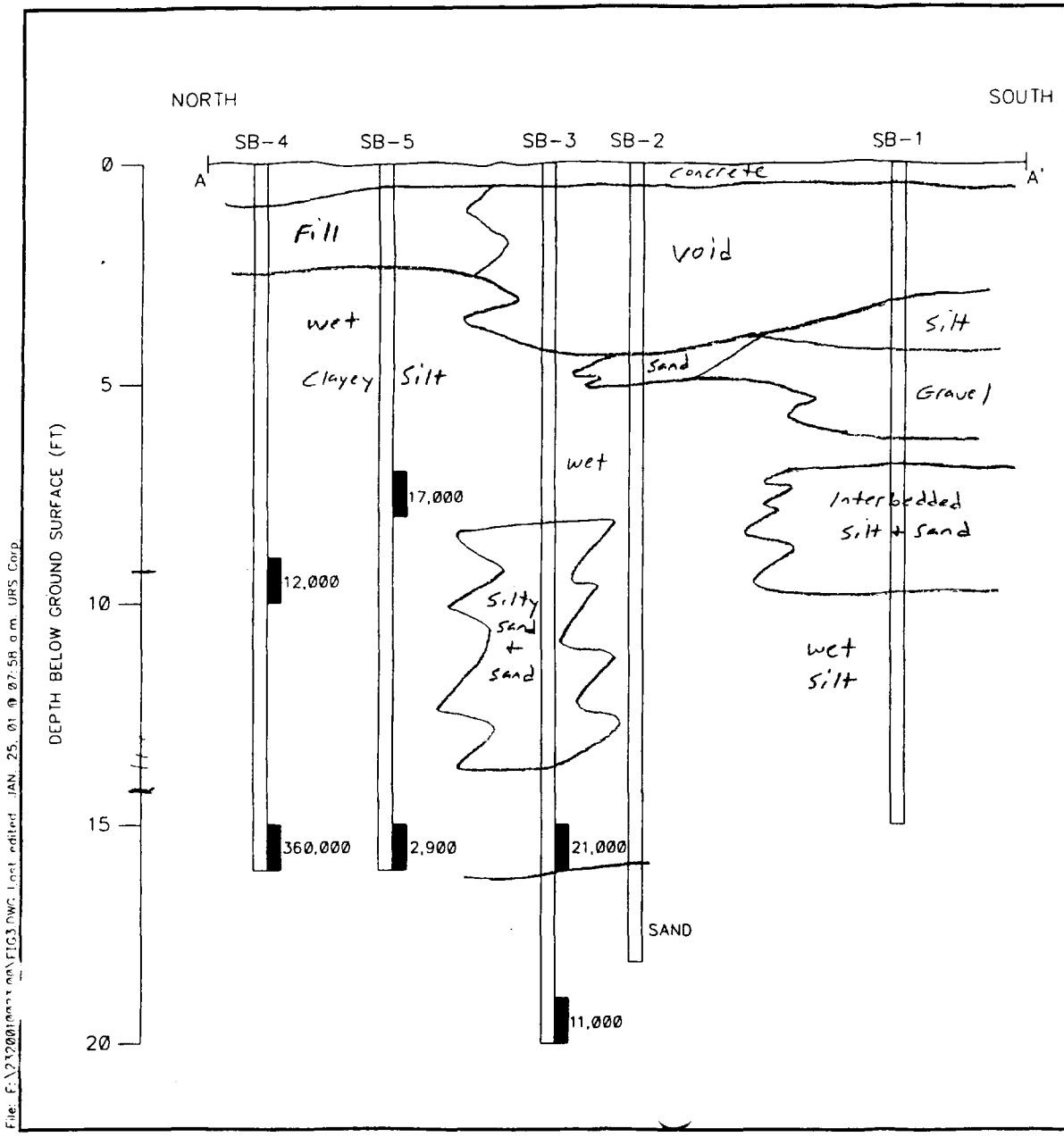
Sample I.D. SB-7		
Analyte	Depth(ft)	
	6-8	14-16
Chlorobenzene	9,200	110

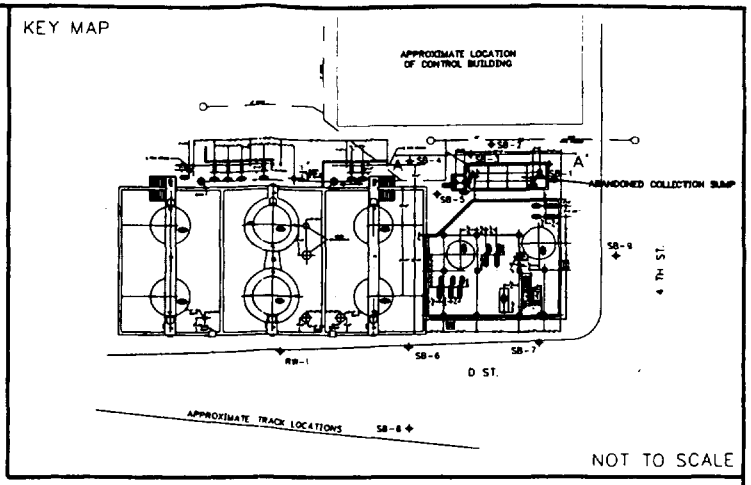
Sample I.D. SB-8		
Analyte	Depth(ft)	
	10-12	14-16
Chlorobenzene	59	42

SCALE 1"=20' FEET

SOLUTIA W.G. KRUMMRICH PLANT MCB RELEASE RECOVERY PROJECT	PROJECT NO. 2320010023.00
URS	
DRN. BY: chs 1/24/01 DSGN. BY: tja CHKD. BY:	Soil and Groundwater Analytical Detections — FIG. NO. 2

File: E:\2320010023.00\FIG2.DWG Last edited: JAN 24, 01 @ 7:16 p.m. URS Corp





NOTES:

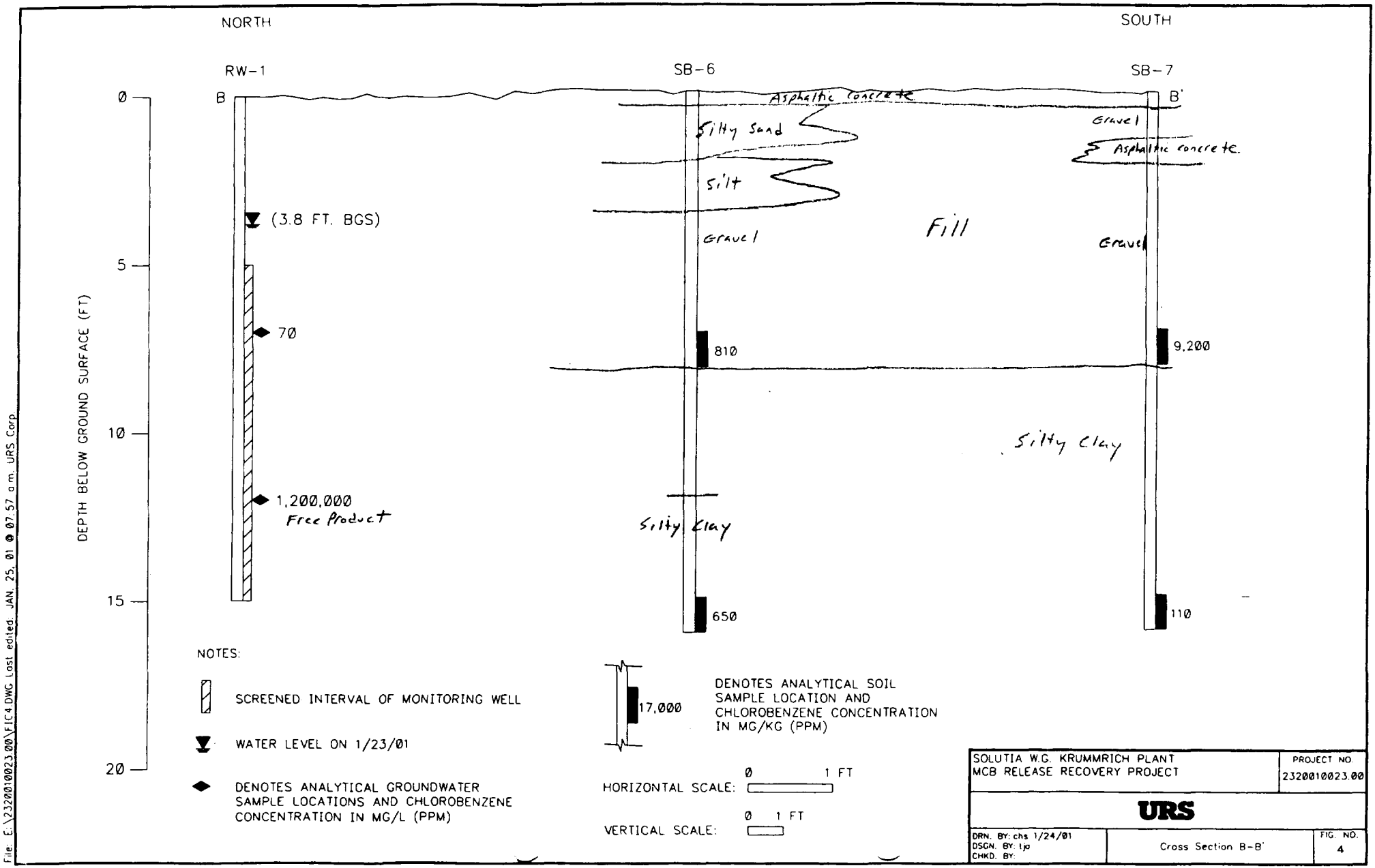
HORIZONTAL SCALE: 0 1 FT

VERTICAL SCALE: 0 1 FT

17,000 DENOTES ANALYTICAL SOIL SAMPLE LOCATION AND CHLOROBENZENE CONCENTRATION IN MG/KG (PPM)

SOLUTIA W.G. KRUMMRICH PLANT MCB RELEASE RECOVERY PROJECT	PROJECT NO. 2320010023.00
URS	
DRN. BY: chs 1/24/01 DSGN. BY: tp CHKD. BY:	Cross Section A-A' / FIG. NO. 3

File: F:\232001\gn\FIG3.DWG Last edited JAN. 25, 01 @ 07:58 a.m. URS Corp



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